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Endocarpon maritima sp. nov. (lichenized *Ascomycota*) from the maritime region of South Korea

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Abstract — A new lichenized fungus, *Endocarpon maritima*, was collected from the rocky seashores of Bogil Island, South Korea. The species is characterized by a squamulose to lobate brown to olive-green thallus attached to the substratum by rhizohyphae, blackish hypothallus, 2-spored asci, spores 25–37.5(–50) × (10.5–)13–17(–20) µm, and a maritime distribution. Lichenized species of *Aspicilia, Buellia, Caloplaca, Phaeophyscia, Physcia,* and *Pterygiopsis* occur in close association with *E. maritima*.

Key words — pyrenocarpous lichen, taxonomy, *Verrucariaceae*

Introduction

The cosmopolitan pyrenocarpous squamulose to subfoliose lichen genus *Endocarpon* Hedw. is represented by ca. 50 species (Kirk et al. 2008) and occupies a wide range of habitats, such as terrestrial, maritime, or fresh water, depending on the species. The genus has been well worked out in India (Singh & Upreti 1984), Australia (McCarthy 1991), New Zealand (Galloway 2007), Japan (Harada 1993), Mexico (Breuss 2000), the Greater Sonoran Desert (Breuss 2002), Costa Rica (Aptroot et al. 2008), and Great Britain (Orange 2008, Giavarini & Fox 2009). However, the genus is not well researched from South Korea and so far is represented by only 4 species (Joshi et al. 2009, Moon & Aptroot 2009).

The maritime *Endocarpon* species comprise important elements in the intertidal and splash zones at the boundary of terrestrial biota, frequently forming with *Verrucaria* a blackish zone. Extensive field surveys of the maritime regions conducted by one author (YJ) during his stay in South Korea revealed an *Endocarpon* species new to science, described here.

Materials & methods

Studied specimens are deposited in KoLRI (Korean Lichen Research Institute, Sunchon, South Korea) and CBM (Natural History Museum and Institute, Chiba, Japan). Description and photographs of external morphology are based on air-dried material observed under a dissecting stereomicroscope (Nikon SMZ 645). Sections made by a razor blade under the stereomicroscope were mounted in lactophenol cotton blue. Anatomical descriptions are based on these preparations studied by a compound microscope (Nikon Eclipse E200). Measurements of ascospores were made at ×400 magnification mounted in water; only free ascospores lying outside the asci were measured. Secondary metabolites were identified by TLC as described by White & James (1985) and Orange et al. (2001) using solvent system C. The mycological terminology follows Kirk et al. (2008).

New species

Endocarpon maritima Y. Joshi & Hur, **sp. nov.** Fig. 1

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Similis Endocarpon ramulosum, E. neopallidulum *et* E. japonicum, *sed differt in maritimum habitio und hypothallus praesens.*

Type: South Korea. Jeollanam-do: Bogil-myeon, Bogil Island, Tong-ri, near Tongri Beach, 34°09′68.4″N 126°35′15.3″E, alt. ca 3 m a.s.l., on exposed rocks, 6 February 2010, Y. Joshi, H. S. Jeon, M. H. Jeong 100197 (**holotype,** KoLRI; **isotype** CBM).

Etymology — The specific epithet refers to its occurrence in the maritime region of South Korea.

Thallus squamulose to lobate, brownish to olive-green, 120–130 µm thick, composed of loosely aggregated squamules, squamules usually lobate at maturity; hypothallus ±present, black, extending beyond the squamules or lobes. Squamules usually adnate or apparently ascending near the margin. Lobules 0.2–0.6 × 0.2–0.4 mm, sparsely or repeatedly, irregularly branched, frequently imbricate, discrete to ±contiguous, margins entire, ±recurved upwards at margin; shape of lobules regular; apically rounded, ±darker than rest of the thallus. Upper surface brown to ±pale brown with olive tinge, slightly glossy, smooth, flat to slightly convex. Lower surface almost black around attaching parts, with sparse rhizohyphae, lacking rhizines. Squamules attached to the substratum at basal ends or central part. Upper cortex paraplectenchymatous, 12.5–20 µm thick, ±pale brown in the uppermost part, hyaline in the remainder. Medulla white, composed of spherical hyphal cells, 20–35 µm thick. Algal layer 50 µm thick, photobiont solitary, in vertical rows in the upper part of layer. Lower cortex undifferentiated from the medulla, dark brown to almost black, 25 µm thick.

Perithecia numerous, 1–4 per squamule/lobule, black, laminal, immersed, globose to somewhat depressed, generally a small black area around ostiole is emerging like a prominent protuberance, ostioles like pale to dark dots or

Figure 1: *Endocarpon maritima* (habit). Scale bar = 5 mm.

indistinct, perithecia pyriform in cross sections, (220–)230 × 250(–270) µm. Exciple dark brown to almost black, 50 µm thick. Subhymenium 25 µm thick. Periphyses 20–50 µm long. Hymenium 70–87.5 × 187.5–237.5 µm, hymenial algae spherical, 5–7.5 µm across. Asci clavate, 75–100 × 20–25 µm, 2-spored. Ascospores hyaline to very pale brown, muriform, ellipsoidal to bacilliform, 25–37.5(–50) × (10.5–)13–17(–20) µm. Pycnidia and conidia not seen.

Chemistry — Spot test reactions: thallus K–, C–, P–. TLC: no lichen substances detected.

Ecology & distribution — The new taxon is thus far confined to the maritime region of South Korea, where it grows luxuriantly over non-calcareous (limestone) rocks in close association with *Aspicilia caesiocinerea* (Nyl. ex Malbr.) Arnold, *Buellia badia* (Fr.) A. Massal., *Caloplaca bogilana* Y. Joshi & Hur, *C. cinnabarina* (Ach.) Zahlbr., *Phaeophyscia hirtuosa* (Kremp.) Essl., *Physcia stellaris* (L.) Nyl., and *Pterygiopsis affinis* (A. Massal.) Henssen. This is a second new species from Bogil Island (the other being *Caloplaca bogilana*) and is so far known only from this island.

Remarks — The new taxon is characterized by a squamulose to lobate, brown to olive-green thallus attached to substratum via rhizohyphae, ±blackish hypothallus, 2-spored asci, and maritime distribution. *Endocarpon ramulosum*

H. Harada and *E. neopallidulum* H. Harada from Japan differ in lacking a hypothallus and being strictly inland species growing between elevations of 200–900 m and 100–150 m, respectively. *Endocarpon japonicum* H. Harada, another closely related species, differs in its different substrate specificity (growth at the edge of streams on partially submerged rocks), absence of a hypothallus, and its inland distribution between elevations of 50–700 m. In its lobate form, *E. petrolepideum* (Nyl.) Nyl. would not be confused with *E. maritima,* because its squamules are mono-lobed and generally scattered to adjacent but not overlapping. *Endocarpon nigromarginatum* H. Harada resembles *E. maritima* in having squamules with conspicuous black borders (i.e. margins) but differs in having both rhizines and rhizohyphae on the lower surface and a ±pachydermatous upper cortex. The presence of a black hypothallus confuses the new taxon with *Endocarpon nigrozonatum* Ajay Singh & Upreti, which differs in having an inland distribution and strictly squamulose morphology.

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